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FISH & GAME DEPARTMENT

Joseph C. Greenley, Director

FEDERAL AID IN FISH AND WILDLIFE RESTORATION

JOB PERFORMANCE REPORT



ST. JOE RIVER CUTTHROAT TROUT AND NORTHERN SQUAWFISH STUDIES

Project F-60-R-4

Job No. 1. Life History of St. Joe River Cutthroat Trout (Research)

March 1, 1972 to February 28, 1973
by

T. C. Bjornn
J. B. Athearn
Idaho Cooperative Fishery Unit
University of Idaho
Moscow, Idaho

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JOB PERFORMANCE REPORT
RESEARCH PROJECT SEGMENT

State of Idaho Name: ST JOE RIVER CUTTHROAT TROUT AND
Project No. F-60-R-4 NORTHERN SQUAWFISH STUDIES
Job No. 1 Title: Life History of St. Joe River
Period Covered: March 1, Cutthroat Trout
1972 to Feb. 28, 1973

ABSTRACT:

Increased numbers of anglers fished the upper St. Joe River in 1972 following a sharp decline in fishing during 1971 when the special regulations were put into effect. Anglers caught an estimated 15,516 fish and kept 6,273 in 1972 compared to 6,964 fish caught and kept in 1968 from the river between Avery and Spruce Tree Campground. Anglers caught three times more cutthroat in 1972 than in 1968 but kept only one-third as many.

Cutthroat trout abundance and mean size increased in the section of river with special regulations. We counted twice as many cutthroat in the Prospector Creek to Spruce Tree section of the river in 1972 compared to before the special bag limits. Rainbow trout of hatchery origin virtually disappeared from the river upstream from Prospector Creek after the annual stocking of catchable-size fish was discontinued in 1971. Cut-throat trout caught by project personnel in 1972 averaged 1-2 inches longer than fish caught in 1969-70 from the river upstream from Prospector Creek.

We compared migratory behavior of cutthroat trout (*Salmo clarki lewisi*) fry from Henrys Lake, Idaho, Kings Lake, Washington, and a St. Joe River (Idaho) tributary using artificial stream channels and test sections in Beaver Creek, Idaho. Many fry from Henrys Lake moved downstream shortly after release in Beaver Creek. Fry from Kings Lake had a tendency to move downstream, and wild fry from Beaver Creek had movement patterns midway between fry from Kings Lake and Henrys Lake. None of the movements by any of the three groups appeared to be related to food availability, water flow, or temperature.

Submitted by: T. C. Bjornn
J. B. Athearn
Idaho Cooperative Fishery Unit

RECOMMENDATIONS:

The studies to evaluate the effects of the special regulations should be continued until the full effects of the changes take effect, probably in 1976 or 1977. The fishery should be monitored to assess effort, catch, catch rate, and species composition. Project personnel should continue to catch and release fish to monitor size and age of fish in the river and count fish in transects to assess abundance.

OBJECTIVES:

To collect and assess selected life history and ecological data on cutthroat trout in the St. Joe River drainage including status of populations, abundance, size of fish, catch by anglers and species composition.

To determine differences in migratory behavior of cutthroat trout from stocks of fish at Henrys Lake, Idaho, Kings Lake, Washington and the St. Joe River.

TECHNIQUES USED:

Creel Census

The creel census conducted on the upper St. Joe River in 1972 was a typical angler count-interview type census similar to that used by Dunn (1968), except that we divided each day into four counting periods rather than the three used by Dunn. The season intervals in 1972 were as follows:

<u>Interval</u>	<u>Dates</u>
1	July 1-4
2	July 5-16
3	July 17-30
4	July 31-August 13
5	August 14-27
6	August 28-September 4

We interviewed all the anglers we could during the scheduled counts and on other trips up and down the river, but the number contacted was too small, in our opinion, to compute the catch by interval. We therefore computed the catch rate and catch only for the entire period of the census (July 1 - September 4).

The upper river clerk censused the river from Prospector Creek upstream to Spruce Tree Campground. We divided the census area into two zones: (1) Prospector Creek to Gold Creek and (2) Gold Creek to Spruce Tree Camp-ground. The clerk for the lower river censused downstream from Prospector Creek and the results of that census are reported by Ortmann (1973).

Status of Population

We continued to assess the status of the cutthroat trout population in 1972 by counting fish in the transects established in 1969 using snorkeling gear and by monitoring the size of fish in the river.

We counted all fish in transects (see Rankel (1971) for description of transects) distributed as follows in the river from Avery upstream to Ruby Creek during mid-August:

<u>River Section</u>	<u>Number of Transects</u>
Downstream from special regulations area	7
Avery to Prospector Creek	
Area covered by special regulations	
Prospector Cr. to Spruce Tree Campground (road access alongside river)	15
Spruce Tree Campground to Ruby Creek (roadless area)	6
Total	<u>28</u>

Since anglers could keep only the larger fish they caught from the river upstream from Prospectors Creek beginning in 1971, project personnel had to fish each year to obtain a sample of fish from the river. All fish they caught were measured and then returned to the river.

Beaver Creek Studies

Our objectives in this portion of the study were to determine differences in migrating behavior between cutthroat trout (*Salmo clarki* Ilewisi, Girard) fry from Henrys Lake, Idaho, Kings Lake, Washington, and a tributary of the St. Joe River, Idaho with respect to their desirability as donor stocks.

These studies were conducted in Beaver Creek or in artificial channels with Beaver Creek water. Beaver Creek flowed eastward from its origin near the St. Joe – Clearwater River divide 12 km to where it entered the St. Joe River 3.3 km downstream from Red Ives Ranger Station (Figure 1). Beaver Creek had a 3.5% gradient from its source down to where Bad Bear Creek entered from the southwest (Mauser, 1972) and 1.2% from Bad Bear Creek to the mouth. Average altitude of the test sections was 1219.2 m above sea level. In the test sections the bottom was composed of about 80% gravel and rubble with a pool to riffle ratio of 1:0.6. Flows in 1972 were above average throughout the summer because of a large snow pack. Temperatures ranged from 4 to 13 C in early June to 10 to 22 C in August (Figure 2). Bad Bear Creek averaged about 2 C colder than Beaver Creek at its mouth. In the test sections of *Beaver Creek* we found only cutthroat and sculpins. Although we did not count sculpins, they were abundant.

The temporary weirs built by Mauser (1972) were used to separate the study sections in Beaver Creek. In addition to the downstream traps already present we built spill traps to catch fry migrating near the surface and stream edge. When we found that the fry could escape through the 8 x 8 hardware cloth (3 mm mesh opening) used on the traps, we changed it to 16 x 16 (1.5 mm mesh opening).

In 1972 we could not get large numbers of fry from Kings Lake to plant in the stream sections so we used fry from fish collected from an inlet to Henrys Lake, Idaho. Irving (1956) described the Henrys Lake stock as being dominated by cutthroat from Yellowstone Lake, Wyoming, and Gold Creek, Idaho (Priest Lake Drainage). The Henrys Lake fry were incubated in vats at the state hatchery at Mullen, Idaho, with minimum waterflow conditions (no noticeable current by observation) to eliminate any rheotactic acclimation. Bowler (1972) suggested that "different acclimating procedures can modify innate responses to water current among inlet fry."

The fry from Henrys Lake were delivered to Beaver Creek on August 3 at swim-up stage before they began feeding (less than 25 mm total length). Approximately 12,000 fry were released in the stream near the middle of section 3 and 6000 near the middle of section 4 (Table 1). To allow time to get the downstream trap at weir 3 into operation the 24,000 fry released in section 2 were held overnight and released the following morning.

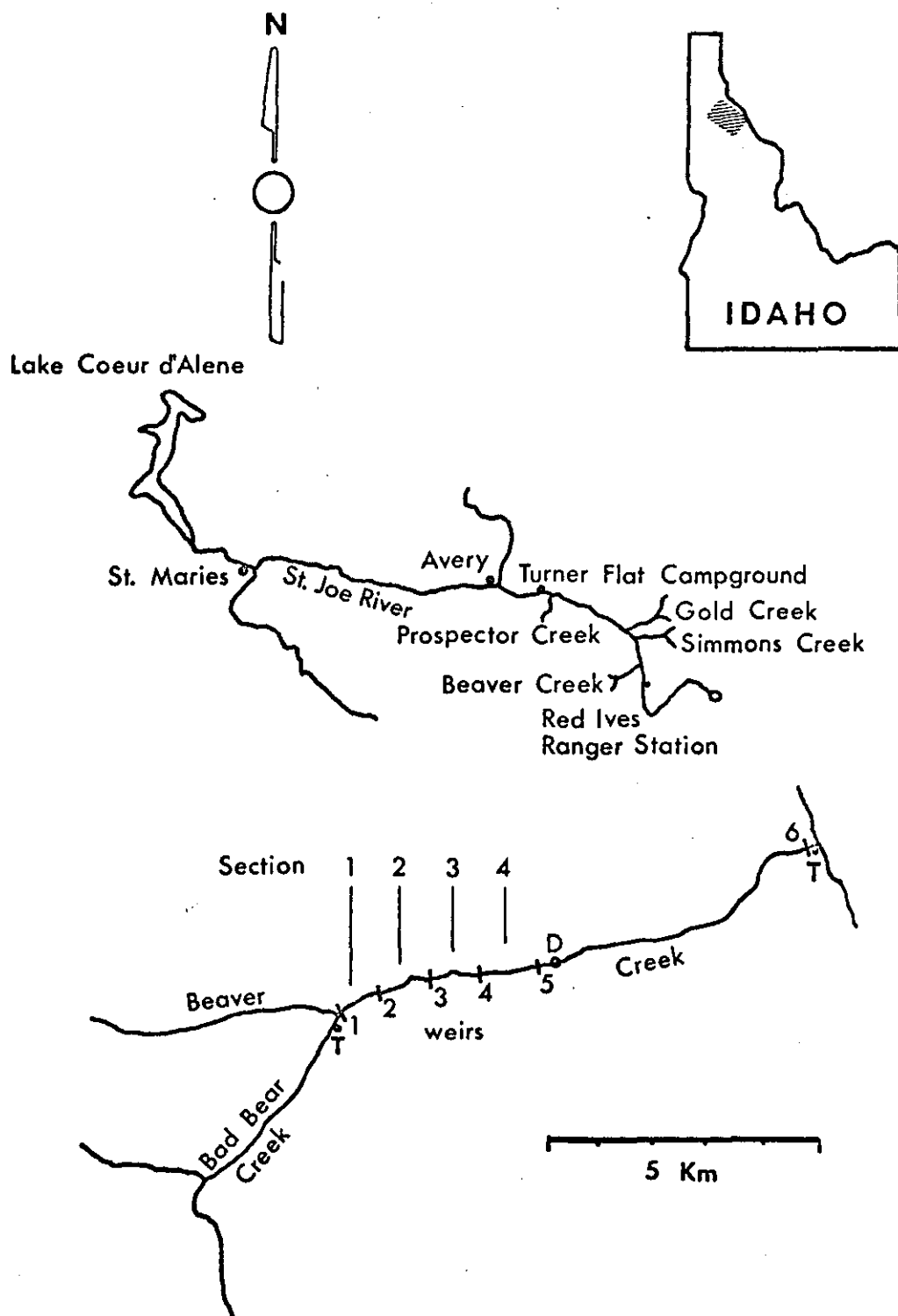


Figure 1. Location of Beaver Creek in the St. Joe River drainage, the study sections within Beaver Creek, thermometer placement (T), and drift sampling site (D).

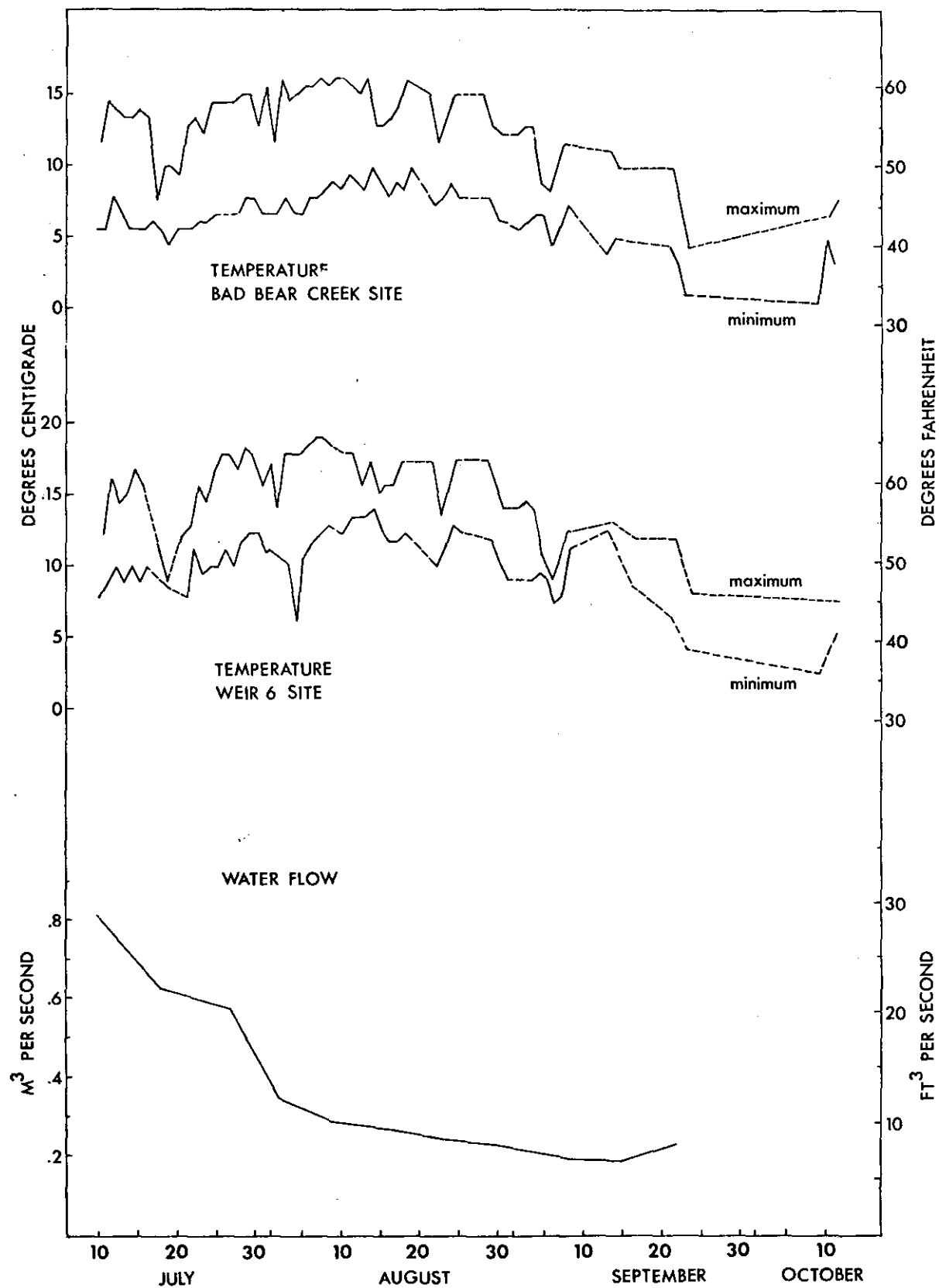


Figure 2. Water flow and temperature profiles for Beaver Creek, Idaho, in 1972.

Section 1 was used as a control. We released more fry in 1972 than Mauser had previously because he felt more than 6000 fry were needed.

An additional 1200 fry from Henrys Lake were held in troughs (2.4 m long, 0.55 m wide, and 0.25 m deep) and used in behavioral studies in artificial stream channels. The 1200 fry from Kings Lake used in behavioral studies came from the Washington Game Department Colville Hatchery on July 26. These fry were reared under standard hatchery conditions and had been feeding since July 17.

Table 1. A comparison of treatments for cutthroat trout in sections of Beaver Creek, Idaho, in 1971 (Mauser, 1972) and 1972.

Stream Section	1971		1972	
	No. of Transects	Treatment	No. of Transects	Treatment
1	48	+6176 fry* +193 older	40	Control
2	64	Control	42	+24,000 fry**
3	58	+6176 fry* -105 older	36	+12,000 fry**
4	58	-100 older	39	+6000 fry**

*fry from Kings Lake

**fry from Henrys Lake

We made underwater snorkeling transect counts to assess the cutthroat population and changes in summer density. We used high-velocity riffle areas, water falls, and log jams as boundaries for transects. Each stream section consisted of about 40 transects (Table 1). We counted all cutthroat present in every fourth transect (average of 10 transects counted per section) weekly. We grouped fish as fry, "small" (50-100 mm total length), "medium" (100-150 mm total length), or "large" (greater than 150 mm).

The estimated population of all sizes of cutthroat trout were made by multiplying the mean numbers of each size group of fish counted per transect in a section by the total number of transects in that section. This was a minimal estimate because fish within the boundary areas between transects were not counted.

We looked for behavioral differences in rheotactic responses of cutthroat fry in modified artificial channels used by Bowler (1972) and Raleigh and Chapman (1971) (Figure 3). We placed partitions at 0.61 m intervals to create calm water areas and constrictions with a stronger current to make the fry deliberately swim in the current to move up or down stream. We covered the bottoms of the channels with sand and small gravel (up to 1 cm in diameter). The compartments were assigned numbers to facilitate recording

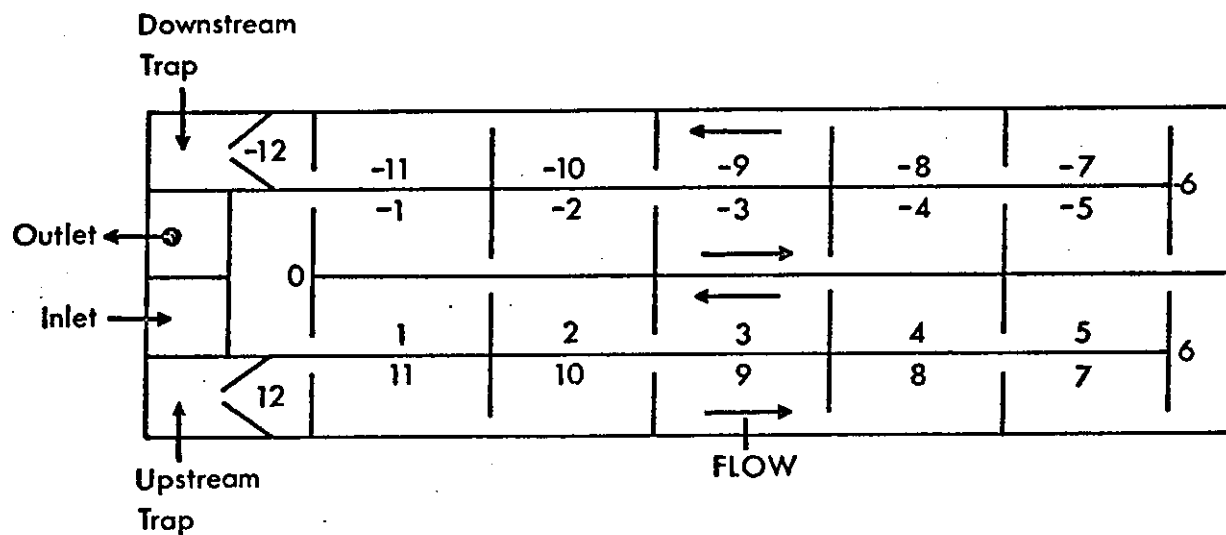


Figure 3. Schematic diagram of an artificial stream channel with the numbered compartments (0-12) in an upstream or downstream direction from the release compartment (0).

of fry movement (+1 to +12 and -1 to -12 for upstream and downstream movement respectively). We piped water from weir 5 in Beaver Creek 30.5 m to the channels and holding troughs. Water velocities obtained through the channel constrictions (12-15 cm/sec) were similar to those used by other workers studying various species of salmonid fry. For each test, fry to be tested were placed in the middle (compartment 0) of the channels just before dark each night and allowed to move freely for approximately 12 hours. We then counted the fry in each compartment to assess the distance up- or downstream they had moved.

We tested 2 groups of fry from Kings Lake 3 days after arrival at Beaver Creek (fed and not fed for the 3 days) and again after 2 weeks (fed the whole time). We also tested Kings Lake fry held in current, with and without food, for 2 days. Fry from Henrys Lake were tested the night of arrival and again after 10 days. We caught wild fry in Beaver Creek above the confluence with Bad Bear Creek and tested them immediately and again after they had been held a week.

To compare interactions between stocks we tested mixtures of fry: Henrys Lake versus wild, Henrys Lake versus Kings Lake, and Kings Lake versus wild. In order to distinguish between Henrys Lake and wild fry we used a dye. We found that Bismark Brown Y at 1:5000 as described by Deacon (1961) caused 100% mortality among the test fish. We then used a 10 ppm concentration of methylene blue (suggested by Dr. G. W. Klontz). The fry were held in the dye for 1.5 hours prior to testing and 0.5 hour in water from the channels for acclimation. The fry from Kings Lake were larger than both the Henrys Lake and wild fry and could be distinguished on the basis of size alone.

No attempt to control light was made; the channels were subject to prevailing weather conditions.

FINDINGS:

Creel Census

We estimate that anglers fished 4400 hours and caught 9,700 fish in Zones 1 and 2 of the upper St. Joe River during July and August of 1972 (Table 2). Anglers returned most (96%) of the fish to the river because the fish were less than the 13 inch minimum size limit or they didn't want to keep them.

The number of anglers fishing the upper St. Joe River declined sharply in 1971 when special regulations were put into effect to reduce the harvest and mortality of cutthroat trout (Table 3). Anglers fished 2216 hours in the Gold Creek to Spruce Tree section of the river in 1968 but only 620 hours in 1971. In 1972, more anglers fished the portion of the river with special regulations than in 1971 (4400 hours versus 1556 hours).

The estimated number of fish caught increased from 6,964 fish caught and kept in 1968 to 15,516 fish caught and 6,273 kept in 1972. In 1968, anglers caught and kept an estimated 3,172 cutthroat and 3,739 rainbow trout from the section of the river between Avery and Spruce Tree Camp-ground (Table 3). In 1972, anglers caught and kept an estimated 1,170 cutthroat and 5,043 rainbow trout from the same section of river. The anglers also caught and released 9,264 cutthroat from the river between Prospector Creek and Spruce Tree Campground in 1972. Anglers caught three times more cutthroat trout in 1972 than in 1968 but kept only one-third the number they kept in 1968.

Rainbow trout which made up half the catch by anglers in 1968 contributed less than 1% of the catch in 1972 upstream from Prospector Creek (Table 3). Prior to 1971, Fish and Game Department personnel released hatchery-reared rainbow trout all along the St. Joe River. In 1971 they discontinued stocking hatchery rainbow trout upstream from Prospector Creek and few of the fish released in 1970 survived until 1971 or 1972.

Table 2. Estimated number of hours fished and fish caught from the upper St. Joe River by anglers in 1972.

Interval	Prospector Creek to Gold Creek Zone 1		Gold Creek to Spruce Tree Campground Zone 2	
	Hours	Fish	Hours	Fish
1	303	-- ^{1/}	160	-- ^{1/}
2	144	--	16	--
3	712	--	224	--
4	644	--	266	--
5	630	--	455	--
6	669	--	158	--
Total	3103	6068	1279	3583

^{1/} Fish caught not calculated for interval of season.

Status of Population

Cutthroat trout abundance increased in the stretch of river with special regulations designed to prevent harvest of small fish, but did not increase in the section with standard fishing regulations. We counted few cutthroat trout in the transects between Avery and Prospector Creek before (1969 and 1970) or after (1971 and 1972) the special regulations were put into effect (Table 4). We counted twice as many cutthroat trout in 1971 and 1972 in the transects between Prospector Creek and Spruce Tree Campground compared to 1969 and 1970. We counted more cutthroat in 1972 in the transects between Spruce Tree Campground and Ruby Creek than we did in 1969-71.

Table 3. Comparison of creel census data for the upper St. Joe River during the months of July and August.

Area and data	Y E A R S		
	1968	1971	1972
<u>Avery to Gold Creek</u>			
Hours fished	7542	--	--
Fish caught and kept	5156	--	--
Cutthroat	44%	--	--
Rainbow	55%	--	--
Other	1%	--	--
<u>Avery to Prospector Creek</u>			
Hours fished	--	4169	5538
Fish caught and kept	--	6375	5865
Cutthroat	--	25%	13%
Rainbow	--	73%	86%
Other	--	2%	1%
<u>Prospector Creek to Gold Creek</u>			
Hours fished	--	936	3103
Fish caught	--	--	6068
Cutthroat	--	--	99%
Rainbow	--	--	< 1%
Other	--	--	< 1%
Fish kept	--	25	326
Cutthroat	--	0%	100%
Rainbow	--	100%	0%
Other	--	0%	0%
<u>Gold Creek to Spruce Tree Campground</u>			
Hours fished	2216	620	1279
Fish caught	--	--	3583
Cutthroat	--	--	99%
Rainbow	--	--	< 1%
Other	--	--	< 1%
Fish kept	1808	60	82
Cutthroat	50%	50%	100%
Rainbow	50%	0%	0%
Other	0%	50%	0%

The abundance of rainbow trout in the river upstream from Prospector Creek declined after 1970 when stocking of hatchery-reared trout was discontinued (Table 4). We counted more rainbow trout in the transects between Avery and Prospector Creek in 1971 and 1972 compared to 1969 and 1970, probably because hatchery trout formerly released upstream from Prospector Creek were released downstream from the area with special regulations. We counted an average of one rainbow trout per transect in the section from Prospector Creek to Spruce Tree Campground in 1972. The large number of rainbow trout counted in 1971 in this section resulted from fish moving upstream into the lower transects of the section after they were released at the mouth of Prospector Creek. The upper transects of the Prospector Creek to Spruce Tree Campground section of the river contained few, if any, rainbow trout in 1971. Rainbow trout virtually disappeared from the river upstream from Spruce Tree Campground in 1971 and 1972.'

Table 4. The mean number of trout counted in established transects in the St. Joe River from Avery to Ruby Creek.

Area of River	Cutthroat				Rainbow			
	1969	1970	1971	1972	1969	1970	1971	1972
Avery to Prospector Creek (without special regulations)	0.5	0.0	2.0	0.5	3.3	5.3	10.1	10.1
Prospector Creek to Spruce Tree Campground (road access to river)	4.6	5.8	11.1	11.2	4.8	17.8	15.6	1.0
Spruce Tree Campground to Ruby Creek (access to river by trail)	22.8	22.3	23.5	31.8	1.3	5.0	0.5	0.2

Cutthroat trout caught by project personnel in 1972 were larger than fish caught by anglers and project personnel in 1969-70 (Table 5). Cutthroat caught and released by project personnel in the Prospector Creek to Spruce Tree section of the river averaged 254 mm total length in 1972 compared to 185 mm in 1969-70. Cutthroat trout caught and released upstream from Spruce Tree Campground in 1972 averaged 225 mm in length compared to 201 mm in 1969-70. We believe the larger mean size of fish resulted from the special regulations and reduced harvest of fish.

Table 5. Mean total length (mm) and sample size for cutthroat trout caught from various sections of the St. Joe River. Fish caught in years 1971-1972 were caught and released by project personnel.

	Avery or Prospector Creek to Spruce Tree Campground		Spruce Tree Campground upstream to Ruby Creek	
	Number	Mean	Number	Mean
1969-1970	1152	185	324	201
1971	32	201	20	170
1972	143	254	179	225

Beaver Creek Studies

We counted more than twice as many fry in the test sections of Beaver Creek in 1972 than Mauser (1972) did in 1971 (Table 6). We do not believe the large numbers of fry from Henrys Lake released into sections 2, 3, and 4 in 1972 resulted in the larger numbers we counted. One week after we released the fry we counted equal numbers of fry in the control section (1) and the sections where fry were released (Table 7). We expected higher densities of fry in sections 2, 3 and 4 if the fry we released in those sections were to remain and survive in the sections.

We probably did not obtain accurate counts of the fry moving downstream the first week after fry release because the downstream traps were not effective. We also could not be certain if the fry we observed moving downstream were wild or planted Henrys Lake stock. From the trend of numbers of cutthroat fry caught at the weirs (Figure 4) and the equal numbers of the fry counted in the test and control sections we suspected that many of the fry migrated downstream during the week after release. We attempted to block fry movement at the weirs but observed fry going downstream through the rotating drums. Mauser (1972) did not find the same pattern of movement in 1971; however, he used the larger mesh screen and fry could have moved without his knowledge past the traps and rotating drums. Also, he released fry from Kings Lake and they may not have moved since he found increased densities in stream sections he released fry into.

The larger numbers of fry counted in all sections in 1972 compared to 1971 could have resulted from more wild fry actually present in 1972. The special fishing regulations could have resulted in increased adult survival and more spawning escapement; thus more fry recruitment. In addition, there may have been some difference in effectiveness of counting between our counting in 1972 and Mauser in 1971.

Table 6. Mean numbers counted per transect (mean of first three counts), estimated numbers per section, and biomass per section of cutthroat trout in test sections of Beaver Creek, Idaho, 1971 (Mauser, 1972) and 1972.

Section	Size Group	1971			1972		
		No/ transect	No/ section	Biomass/ section (g)	No/ transect	No/ section	Biomass/ section (g)
1	Fry	4.2	200.0	58.00	11.0	440.0	127.60
	Small	1.4	68.0	4141.88	2.0	80.2	4872.80
	Medium	4.6	221.3	3600.55	4.3	172.0	2798.44
	Large	2.2	105.3	342.23	5.3	212.0	689.00
	Total	8.2	394.6	8142.66	11.6	464.0	8487.84
2	Fry	0.8	48.0	13.92	9.7	407.4	118.15
	Small	0.5	33.3	2028.30	2.3	96.6	5883.91
	Medium	2.0	128.0	2082.56	5.8	243.6	3963.37
	Large	2.1	132.0	429.00	8.3	384.6	1249.95
	Total	4.6	293.3	4553.78	16.4	724.8	11215.38
3	Fry	5.2	302.4	87.70	16.7	601.2	174.35
	Small	1.3	74.6	4543.89	1.5	54.0	3289.14
	Medium	2.4	113.1	1840.14	5.3	190.8	3104.32
	Large	1.0	55.2	179.40	8.3	298.8	971.10
	Total	4.7	242.9	6651.13	15.0	543.6	7364.56
4	Fry	0.9	53.9	15.63	16.0	624.0	180.96
	Small	1.1	62.1	3782.51	1.4	54.6	3325.69
	Medium	2.6	151.2	2460.02	4.6	179.4	3918.84
	Large	1.2	70.4	228.80	6.1	237.9	773.18
	Total	4.9	283.7	6486.96	12.1	471.9	7198.67
Grand Total			1818.8	25,834.53		4276.9	34,266.45

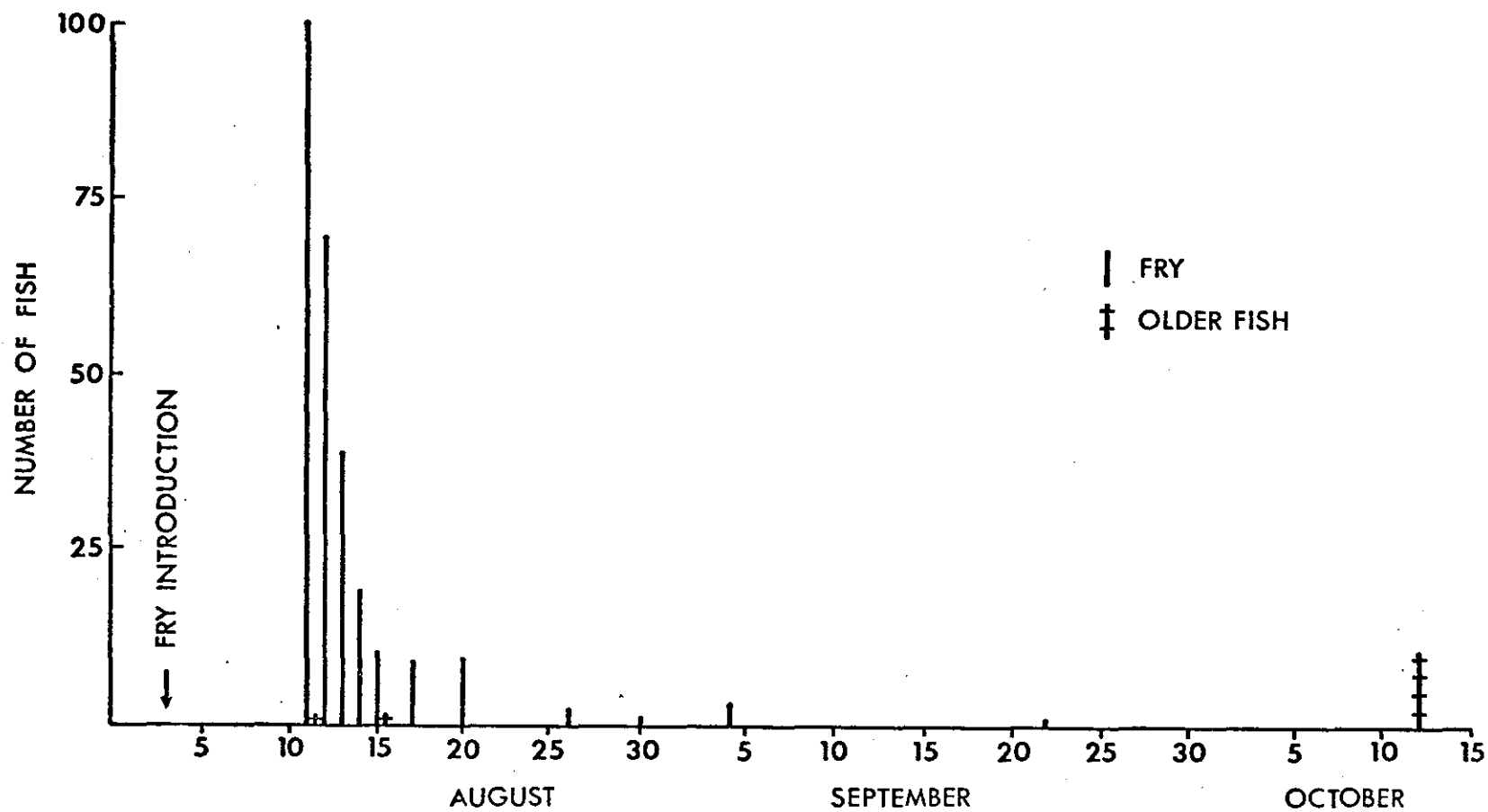


Figure 4. Numbers of downstream-moving cutthroat trout past all weirs in Beaver Creek, Idaho, in 1972.

Table 7. Population estimates of cutthroat trout in each test section of Beaver Creek, Idaho, August 10 to September 22, 1972.

	Age	8/10-13	8/17-18	8/24-25	8/31-9/1	9/7-8	9/15	9/22
Section 1	Fry	592	340	392	308	221	264	180
	≥ 1+	464	460	476	344	360	336	168
	Total	1056	800	868	652	692	600	348
Section 2	Fry	559	361	298	454	412	265	113
	≥ 1+	664	739	668	567	571	353	63
	Total	1223	1100	966	1021	983	618	176
Section 3	Fry	508	752	540	456	348	204	148
	≥ 1+	528	576	520	404	288	184	120
	Total	1036	1328	1060	860	636	388	268
Section 4	Fry	676	702	490	420	360	182	165
	≥ 1+	490	503	429	321	247	178	95
	Total	1166	1205	919	741	607	360	260

We counted more older cutthroat trout in the sections in 1972 than Mauser (1972) did in 1971 (Table 6). Increased survival between 1971 and 1972 could not account for all the 1972 increase so we concluded the difference either to be due to counting error or more fish moved into the test sections prior to weir reconstruction in 1972.

We also observed almost 3 times as many fry per m² in 1972 as were reported in 1971 (Mauser, 1972) and almost twice as many cutthroat in the older groups over the 1971 counts (Table 8). There was a slight increase in biomass per stream section in 1972 (using Mauser's 1971 factors for calculating mean biomass per section) over 1971.

Table 8. Area of each section and density of cutthroat trout expressed as biomass, fry, and fish age 1 and older (per m²) in Beaver Creek, Idaho. Data for 1971 from Mauser (1972).

		Area (m ²)	Biomass (g/m ²)	Fry/m ²	Age 1 and Older Fish/m ²
1971	Section 1	3773.3	2.2	0.05	0.10
	Section 2	4568.1	1.0	0.01	0.06
	Section 3	4635.8	1.4	0.07	0.05
	Section 4	6114.1	1.1	0.01	0.05
	Total	19,091.3	5.7	0.14	0.27
	Mean	4772.8	1.4	0.04	0.07
	Grand Mean			0.10	
1972	Section 1	4460.2	1.9	0.10	0.10
	Section 2	4797.9	2.3	0.08	0.15
	Section 3	4664.6	1.6	0.13	0.12
	Section 4	5323.8	1.4	0.12	0.09
	Total	19,246.5	7.2	0.43	0.46
	Mean	4811.6	1.8	0.11	0.12
	Grand Mean			0.22	

The probability of fry moving randomly past 7 partitions in one direction in the artificial channels was less than .01. Therefore, we considered those fry that did move past 7 partitions in one direction as possessing a definite movement pattern.

Nearly all (96.1%) Kings Lake fry held 3 days after their arrival and fed moved upstream and 76.6% of those not fed moved upstream (Figure 5). In both cases 1.3% moved downstream. Most (73.8%) fry from Kings Lake held in current 2 days and fed also moved upstream while only 11.7% moved down-stream (Figure 6). When held in current for 2 days but not fed only 57.2% of the fry went upstream and 7.1% went downstream. When we tested fry from Kings Lake 3 weeks later in a non-partitioned channel 91.6% went upstream with none going down (Figure 7). All of the control fish (partitioned channel) went upstream. These fry had been held in troughs and fed.

Fry from Henrys Lake tested the night they arrived moved mostly up-stream (67.6%) with some (17.7%) moving downstream (Figure 8). After being held 10 days in a trough and fed, few (14.7%) fry went upstream and 43.8% went downstream (Figure 8). When tested 2 weeks later in a non-partitioned channel more fry (34.8%) moved into the upstream trap and less (8.7%) into the downstream trap (Figure 7). Fry from the control group (partitioned

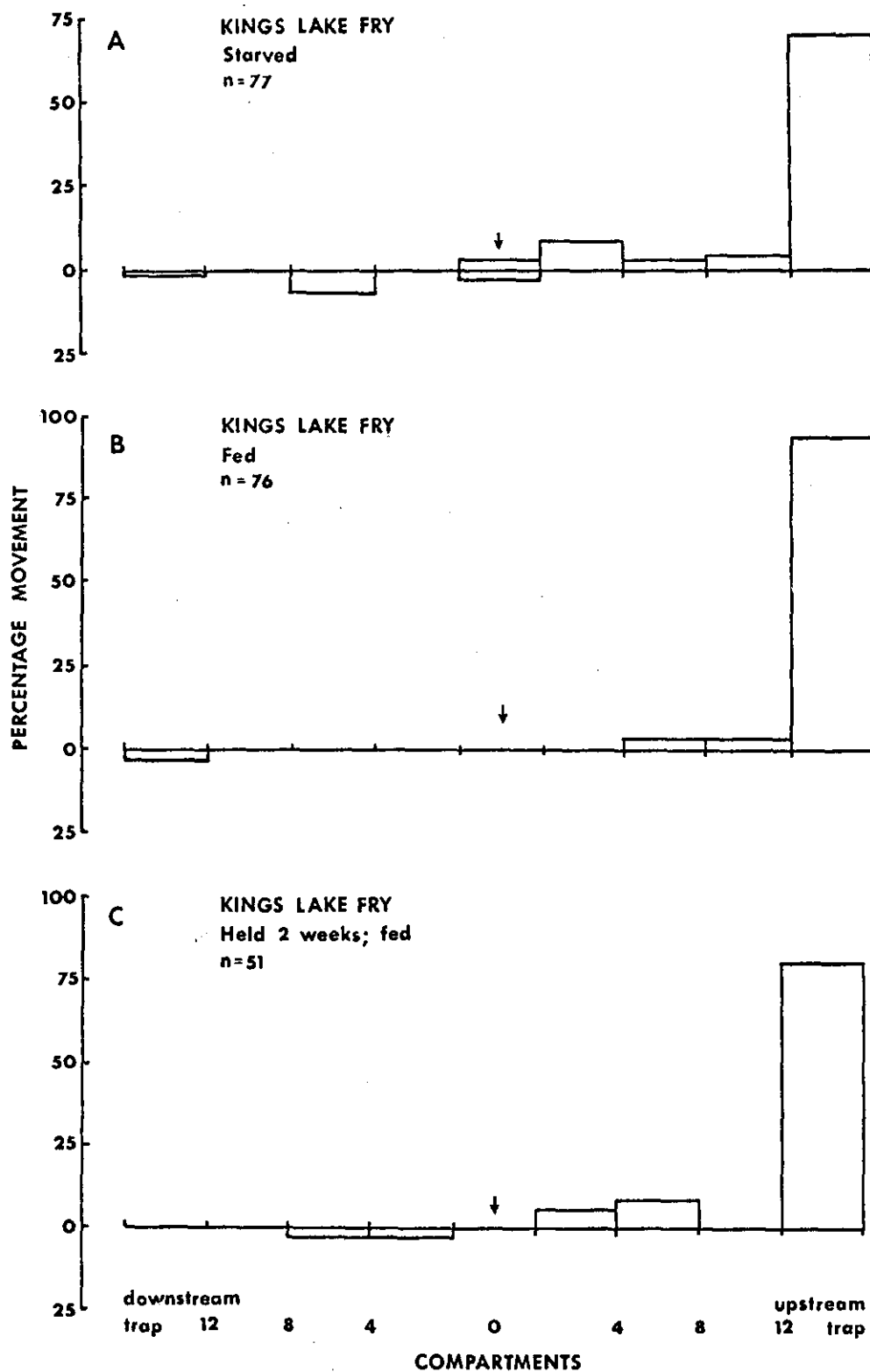


Figure 5. Movement of cutthroat trout fry from Kings Lake in artificial stream channels: groups A and B were tested shortly after arrival with group B fed and group A starved; group C was held 2 weeks and fed. Arrows indicate point of fry release.

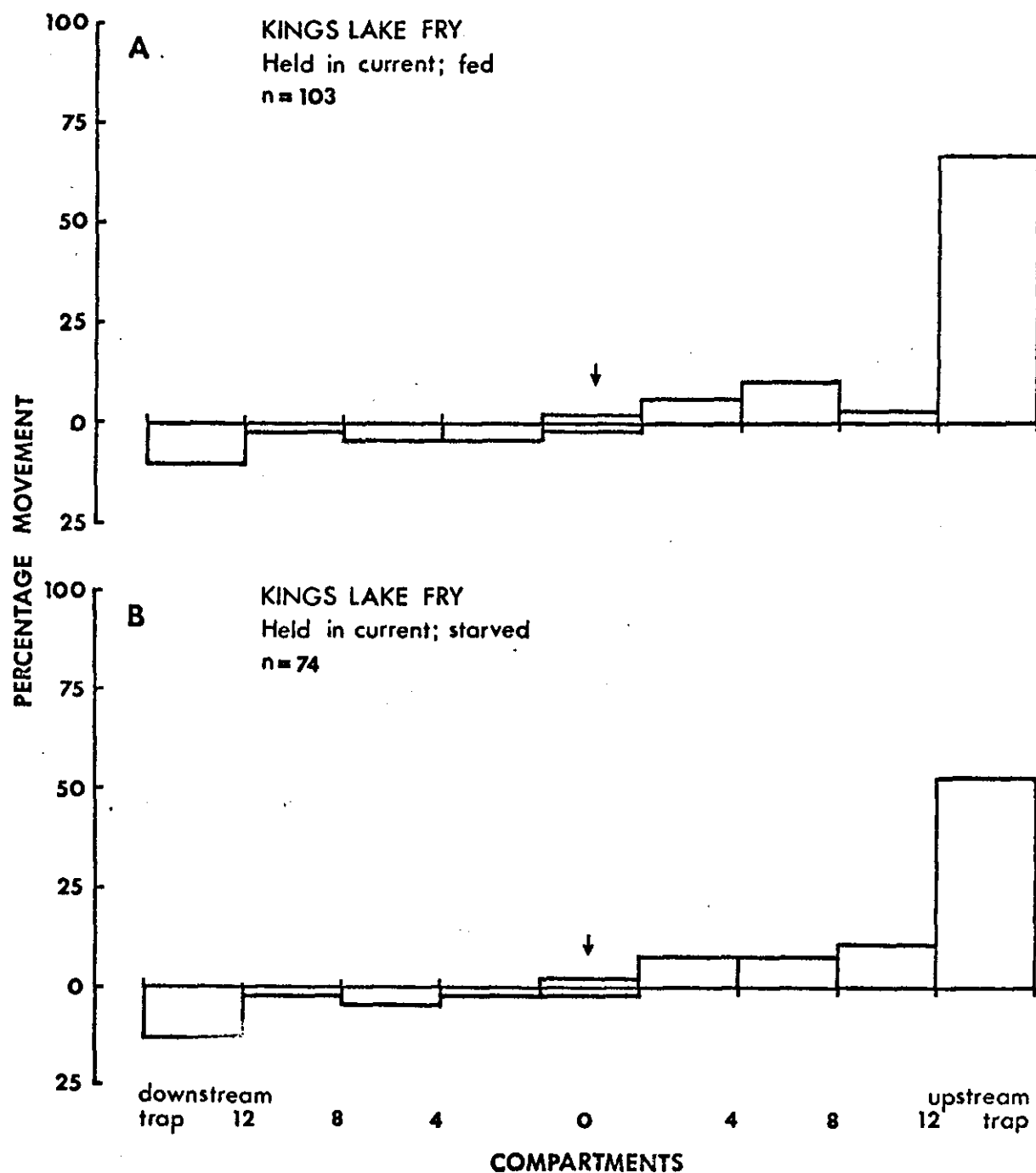


Figure 6. Movement of cutthroat trout fry from Kings Lake in artificial stream channels: group A was held in current for 2 days and fed; group B was held in current 2 days and not fed. Arrows indicate point of fry release.

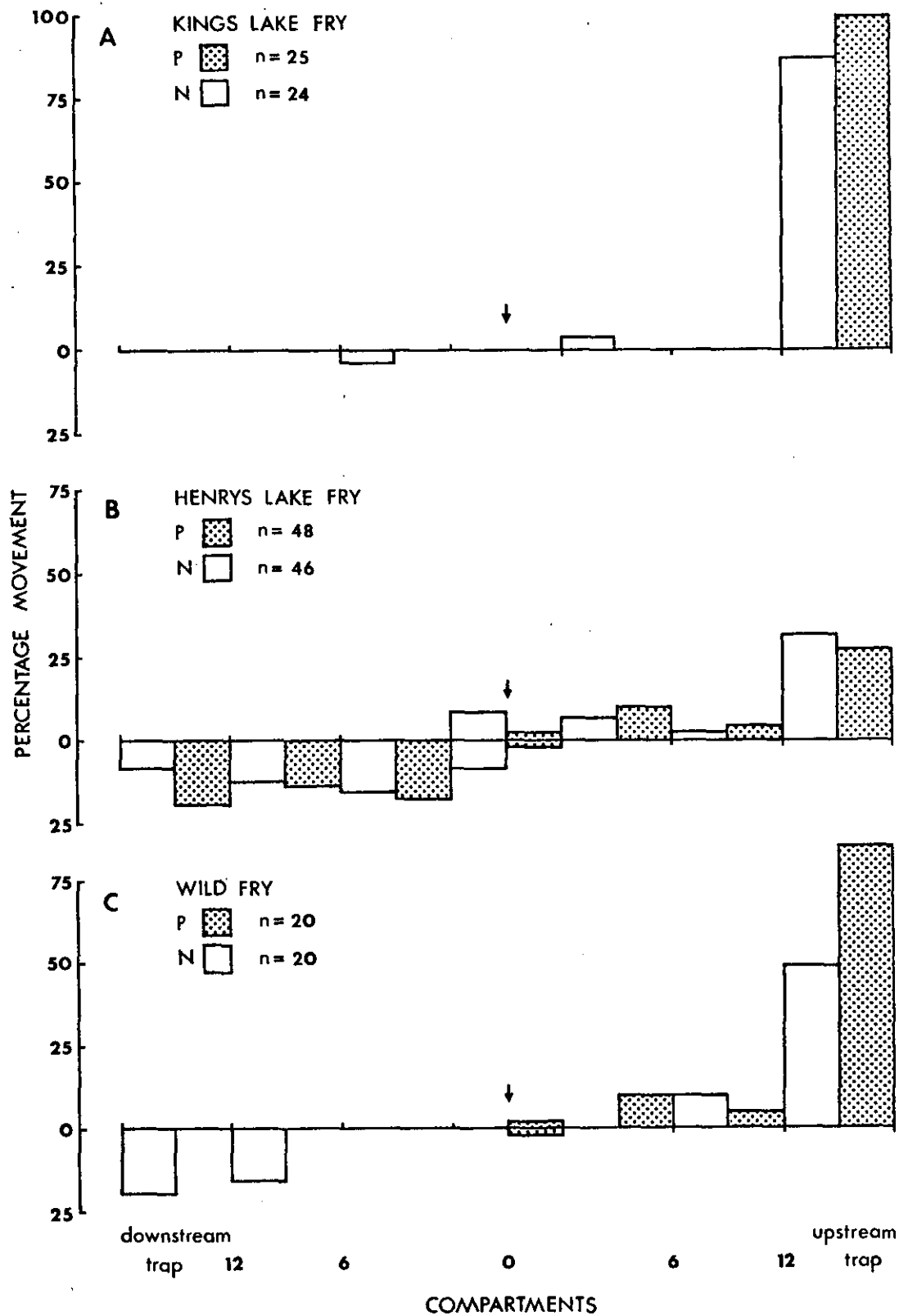


Figure 7. Movement of cutthroat trout fry tested in partitioned versus non-partitioned channels: group A, Kings Lake stock; group B, Henrys Lake stock; and group C, wild fry. Arrows indicate point of fry release.

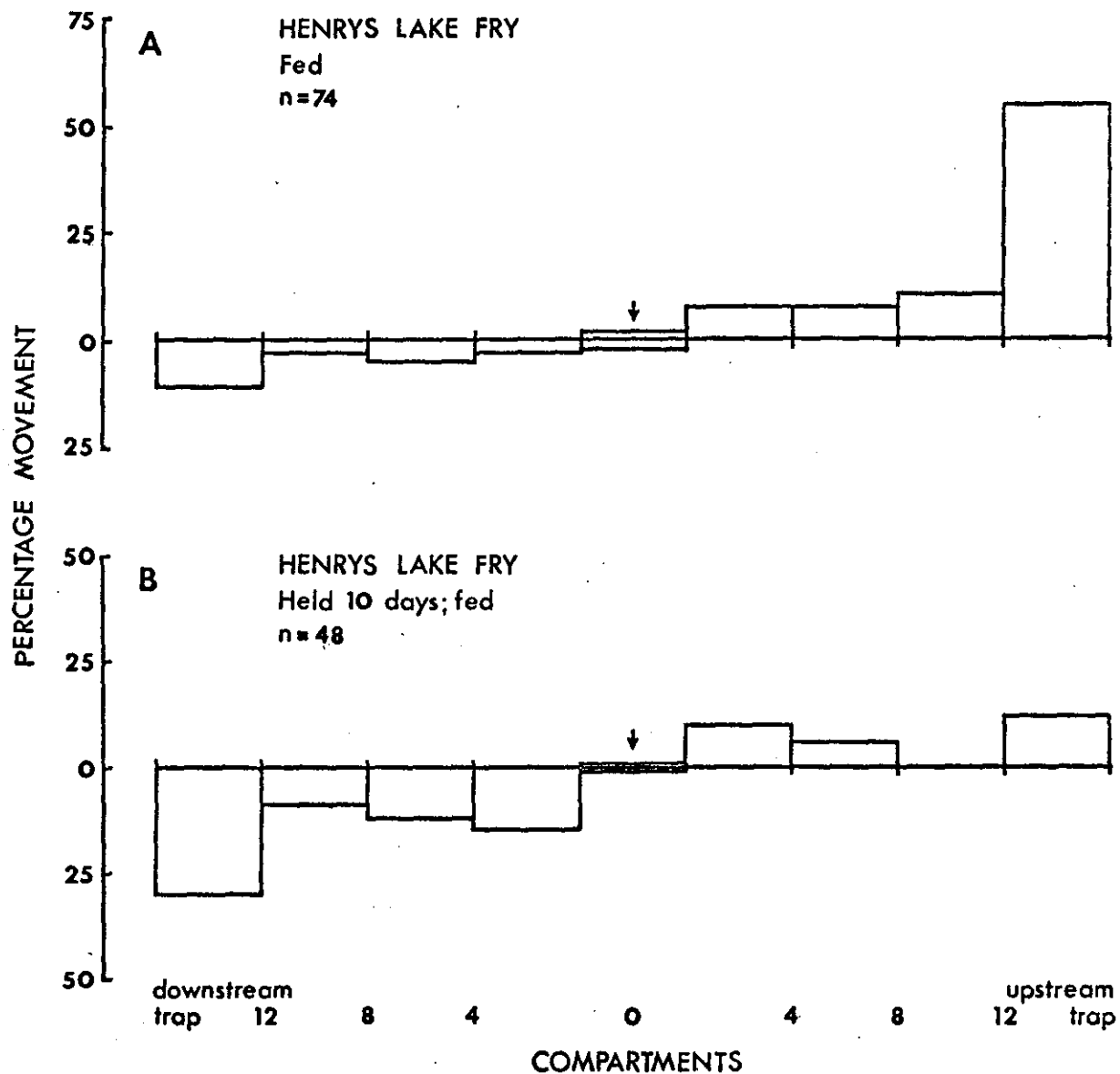


Figure 8. Movement of cutthroat trout fry from Henrys Lake in artificial stream channels: group A was tested on the evening of arrival; group B after being held 10 days. Arrows indicate point of fry release.

channel) moved in similar numbers upstream (33.4%) but more (34.5%) moved downstream.

Almost half the wild fry caught August 6 and tested the next night moved upstream (45.9%) while 33.5% moved downstream (Figure 9). Fry of the same group held a week and then tested moved in similar numbers in both directions (45.2% upstream; 33.6% downstream). Wild fry caught 10 days later moved mostly (68%) upstream with 16% moving downstream. Three weeks later we caught another batch of wild fry and tested them in non-partitioned channels and 50% went into the upstream trap while 20% ended up in the downstream trap (Figure 7). In the control group 90% went upstream and none went down.

When fry from Kings Lake and Henrys Lake were placed together 98.7% and 16.2% of the fry went upstream with 0% and 45.9% going downstream respectively (Figure 10). When fry from the above-mentioned test were put back into the channels and tested in the daylight 88.3% Kings Lake and 26.4% Henrys Lake moved upstream while 1.3% and 38.9% moved downstream respectively.

The fry from Kings Lake behaved nearly the same way when placed with fry from Henrys Lake as 100% of the fry from Kings Lake moved upstream compared to 80.7% of the wild fry which moved in the same direction, and 7.7% moved downstream (Figure 11). The fry from Henrys Lake behaved similarly when mixed with wild fry as they did with fry from Kings Lake with 33.4% going upstream and 26.3% downstream (Figure 11). The wild fry had less tendency to move upstream (48.8%) when mixed with fry from Henrys Lake than when mixed with fry from Kings Lake. Direction of migration of fry tested was not affected when density of mixed stocks in the channels were varied.

When the first transect counts were made August 10-13, 1972, 7 to 10 days after fry were released, all sections were found to contain similar numbers of fry indicating that the planting-of fry from Henrys Lake on August 3 and 4 did not increase the density of fry in the stream. When we did install a downstream trap on August 11 which would retain fry at the weirs we found a large, but declining, number of fry moving downstream (Figure 4). We suspect that most fry released in the stream migrated downstream between August 3 and 15. This downstream movement by fry from Henrys Lake contrasted with the lack of movement Mauser (1972) found for fry from Kings Lake in 1971.

We conclude that, if the management objectives are to provide a donor stock to remain in a tributary to rear, fry from a stock similar to Kings Lake are better suited than fry from Henrys Lake. The fry from Henrys Lake planted in a tributary might move immediately downstream into the river.

Since the fry from Henrys Lake were not acclimated in current and were released as soon as they were swim-up fry they could have been expected to have a downstream tendency as a result of their innate behavior.

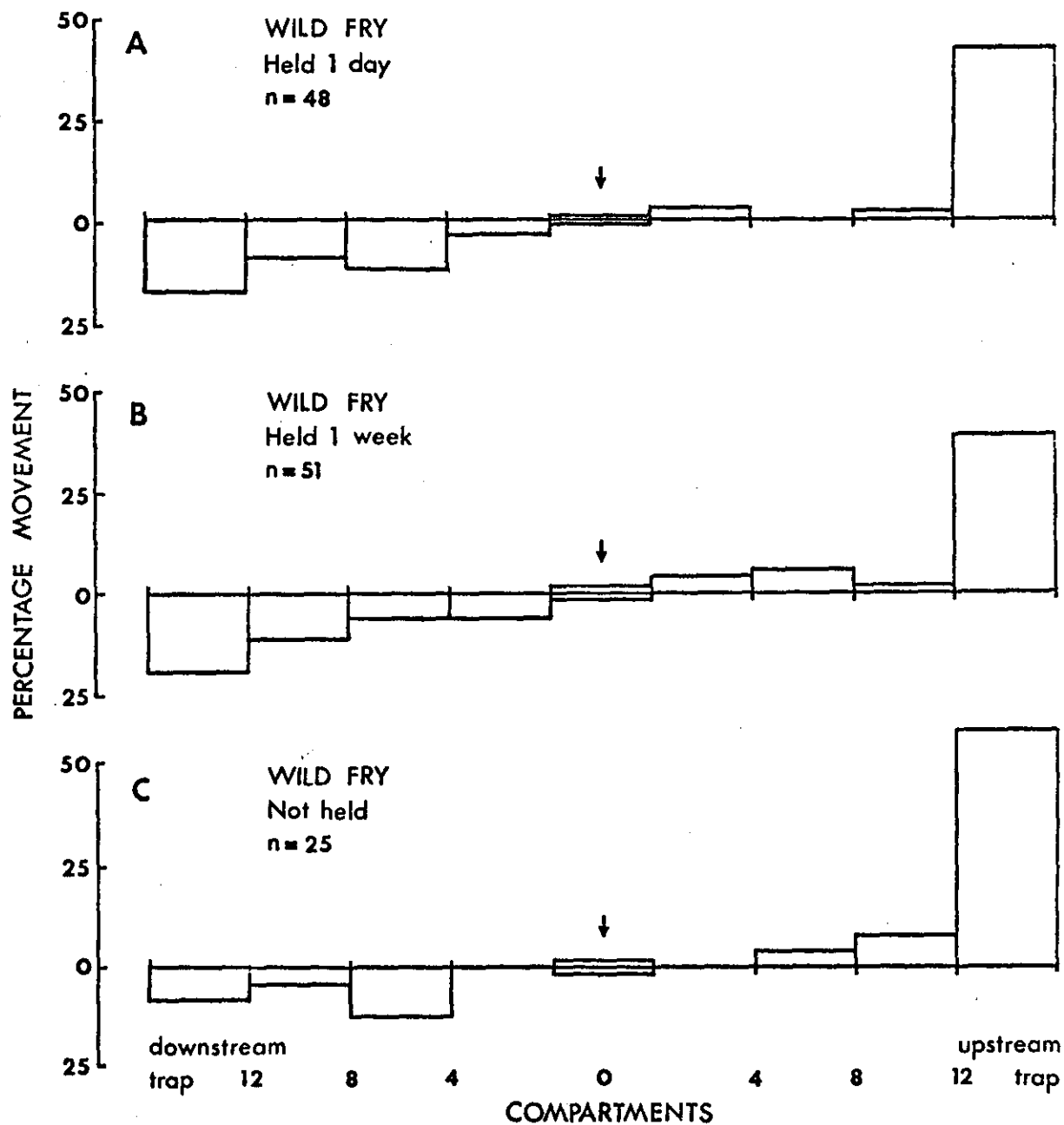


Figure 9. Movement of wild cutthroat trout fry caught in Beaver Creek, Idaho, in 1972, in artificial stream channels: group A was caught August 6 and tested August 7; group B was caught August 6 and tested August 13; and group C was caught August 16 and tested immediately. Arrows indicate point of fry release.

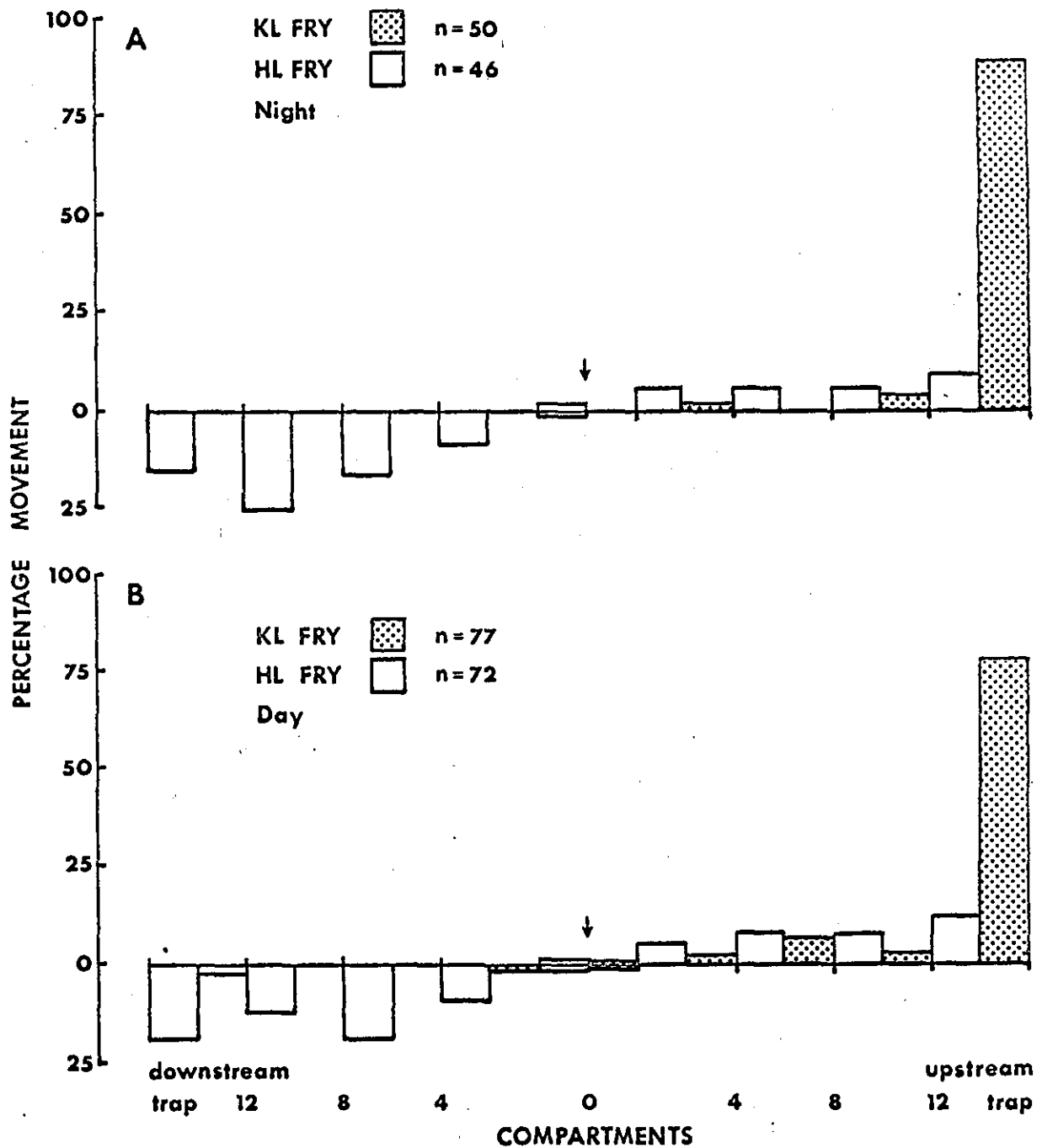


Figure 10. Movement of Kings Lake versus Henrys Lake stocks when placed together in artificial stream channels: group A was mixed and tested overnight; group B was re-tested in daylight. Arrows indicate point of fry release.

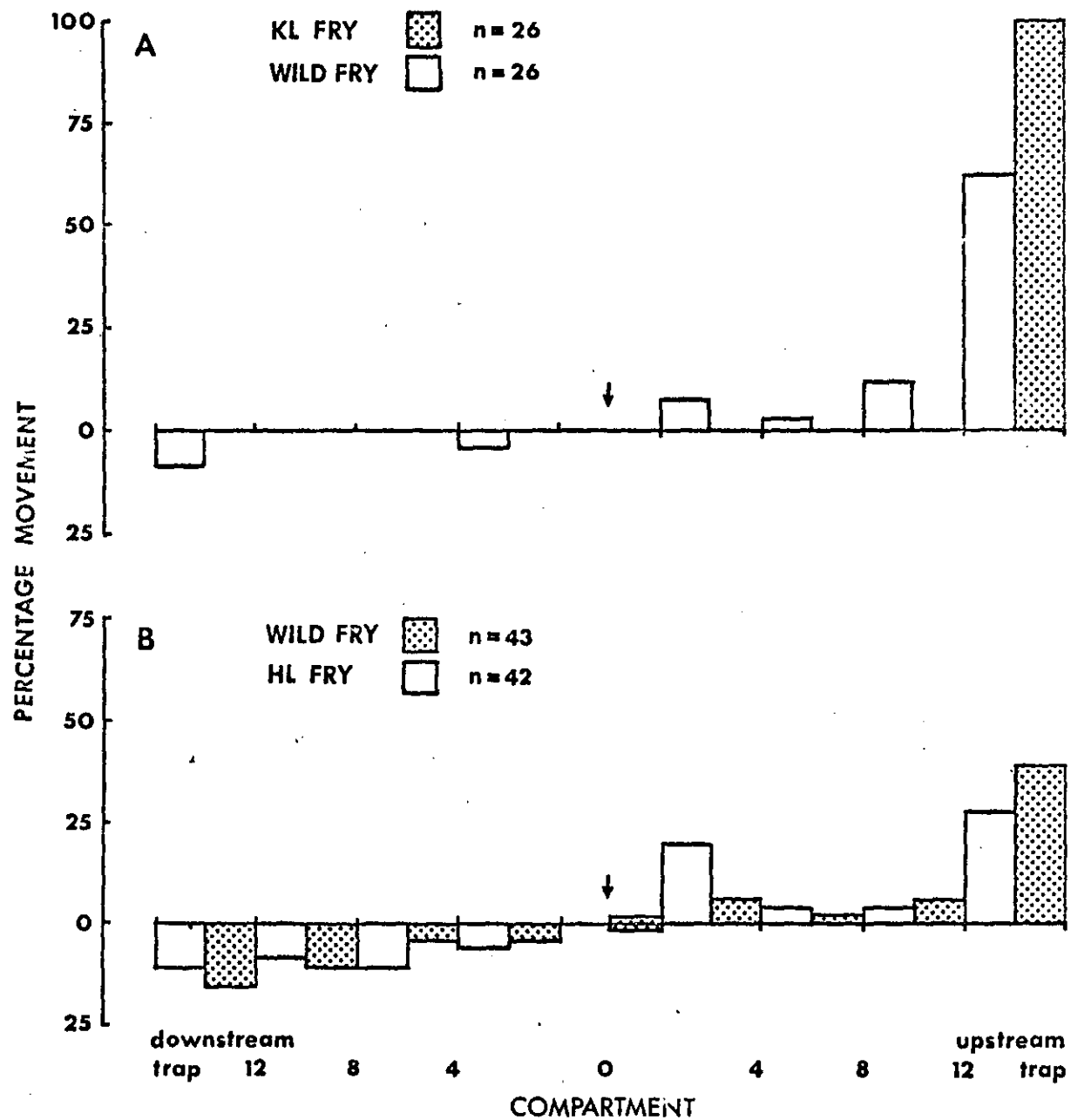


Figure 11. Movement of wild cutthroat trout fry versus Kings Lake stock (group A) and Henrys Lake stock (group B) in artificial stream channels. Arrows indicate point of fry release.

The fact that some still had a small amount of yolk should not have changed their behavioral pattern as I observed them swimming normally and orienting in the stream currents. Brannon (1967) noted that sockeye fry migration was not inhibited by the presence of unabsorbed yolk.

The tendency of the fry from Kings Lake to move upstream was similar to what Bowler (personal communication) found when he tested fry from Kings Lake in artificial stream channels after being held in troughs. The treatment the fry from Kings Lake received in both cases prior to testing was similar to what they would receive in most hatcheries prior to release in a stream.

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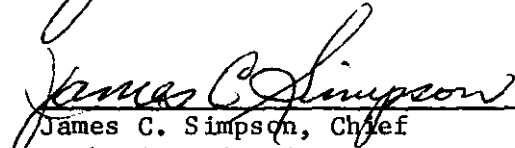
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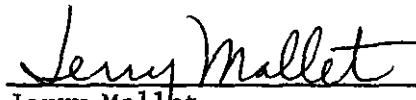
T. C. Bjornn
J. B. Athearn
Idaho Cooperative Fishery Unit

Approved by:

IDAHO FISH AND GAME
DEPARTMENT


Joseph C. Greenley, Director


James C. Simpson, Chief
Fisheries Division


Jerry Mallet
Fishery Research Supervisor